The Relationship of Sleep Disturbance and Symptom Severity, Symptom Interference, and Hospitalization Among Israeli Inpatients With Cancer

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Purpose/Objectives: To examine the relationship of sleep disturbance and symptom severity, symptom interference, and hospitalization among inpatients with cancer.

Design: A descriptive, correlational, comparative design.

Setting: The oncology inpatient unit of a teaching hospital.

Sample: A convenience sample of 82 hospitalized patients.

Methods: Patients completed the Pittsburgh Sleep Quality Index (PSQI)–Home questionnaire, the MD Anderson Symptom Inventory (MDASI), and a demographic data information instrument within 72 hours of admission. Patients hospitalized for 10 days or more completed the PSQI–Hospitalization questionnaire and the MDASI.

Main Research Variables: Sleep disturbance, symptom severity, symptom interference, and hospitalization.

Findings: Although sleep disturbance scores were high at home and during hospitalization, the use of sleeping medication received the lowest score in the PSQI. Patients who were hospitalized for 10 days or more had significantly higher global PSQI scores at home than after being hospitalized for 10 days or more. A significant relationship was noted between global PSQI scores at home and symptom severity total mean scores, with the symptoms of numbness and tingling demonstrating the greatest correlation with sleep disturbance. A tendency existed for a significant relationship between global PSQI scores at hospital and symptom severity total mean scores. The symptom with the greatest correlation with global PSQI scores at hospital was sadness, followed closely by remembering. The interference items with the greatest correlation to global PSQI scores at hospital were patient's enjoyment of life, mood, and relations with others.

Conclusions: Sleep disturbance was less of a problem for patients during their hospitalization than at home. Unlike other studies, numbness was found to be the symptom most closely correlated to sleep disturbance.

Implications for Nursing: Additional investigation should be conducted to identify the factors that influence sleep disturbances in patients with cancer at home and the relationship between sleep disturbance and numbness and tingling.

Sleep disturbance is a common issue among patients with cancer (Berger et al., 2005; Savard & Morin, 2001; Sela, Watanabe, & Nekolaichuk, 2005) and has been reported as one of the most frequent symptoms among patients with breast (Byar, Berger, Bakken, & Cetak, 2006; Davidson, MacLean, Brundage, & Schulze, 2002) or lung cancer (Davidson et al., 2002; Wang, Tsai, Chen, Lin, & Lin, 2008), as well as patients with cancer in general (Ivanova et al., 2005; Yi, Wang, & Ping-Ping, 2008). In addition, insomnia has been reported as the most prominent symptom of hospitalized patients with cancer (Chen & Chang, 2004). Furlani and Ceolim's (2006) study showed that hospitalized, clinically stable patients with gynecologic or breast cancer experienced better sleep quality during hospitalization. Patients whose situation deteriorated did not sleep as well. Other studies indicated that patients undergoing stem cell transplantation (Anderson et al., 2007; Rischer, Scherwath, Zander, Koch, & Schulz-Kindermann, 2009) and those on a neurosurgical unit (Sendir, Acaroglu, Kaya, Erol, & Akkaya, 2007; Ugras & Oztekin, 2007) experienced more sleeping issues during the period of treatment with improvements occurring toward the end of hospitalization. No in-depth published studies were found that examined the nature of Israeli patients' sleep disturbance in an inpatient setting, nor has their sleep disturbance at home been compared with their sleep disturbance in the hospital.

Research studies have demonstrated that sleep disturbance occurs in a cluster with other symptoms (Given, Given, Sikorskii, & Hadar, 2007). Studies that have examined the symptom cluster of fatigue, depression, pain, and sleep disturbance featured sleep disturbance scores as the highest in two of the four patient subgroups, and second to the highest in the other two

subgroups (Miaskowski et al., 2006; Pud et al., 2008). In addition, other symptoms such as pain, depression, cognitive function and fatigue, lack of appetite, shortness of breath, and general distress have been highly correlated and have contributed to sleep disturbance and quality of life issues in patients with cancer (Mystakidou et al., 2007; Wang et al., 2008). The importance of examining symptom burden, which encompasses not only the severity of symptoms but the impact of multiple symptoms on patients, is being increasingly recognized (Cleeland, 2007; Mao et al., 2007). No published studies have examined the relationship of sleep disturbance and symptom burden (defined as symptom severity and symptom interference).

The purpose of this study was to examine the relationship of sleep disturbance and symptom severity, symptom interference, and hospitalization among inpatients with cancer. The following hypotheses were stated.

- A positive relationship will exist between sleep disturbance and symptom severity in hospitalized patients with cancer.
- A positive relationship will be noted between sleep disturbance and symptom interference in hospitalized patients with cancer.
- Sleep disturbance of hospitalized patients with cancer will be greater than their sleep disturbance at home.

Methods

A descriptive, correlational, comparative design was employed. A convenience sample of 82 patients was recruited from the oncology department at Hadassah Ein Kerem Hospital in Jerusalem, Israel. Inclusion criteria consisted of being aged 18 years and older and able to speak Hebrew, Russian, or English. To test the significance of a Pearson's r relationship with a medium effect size of 0.3 and power of 0.8 at the 0.05 level, a sample size of 82 was suggested (Cohen, 1992).

Instruments

The authors used four questionnaires in the study, the Pittsburgh Sleep Quality Index (PSQI), the MD Anderson Symptom Inventory (MDASI), a demographic data information questionnaire, and a disease and treatment questionnaire.

Pittsburgh Sleep Quality Index: The PSQI is a 19-item questionnaire that was developed to measure sleep quality and sleep disturbance (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989). It measures seven components of sleep (sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbance, use of sleeping medications, and daytime dysfunction) in the prior four weeks. Each of the components has a score range of 0–3, and the global sleep quality score is obtained by summing the seven components. The PSQI has demonstrated validity and reliability among patients with cancer (Carpenter & Andrykowski, 1998) and has been used in studies that focus on sleep quality for patients with cancer (Beck et al., 2010; Mystakidou et al., 2009). The current study used the PSQI in three languages (Russian, English, and Hebrew)—the original English version (Buysse et al., 1989) was used, the Russian version was obtained from the official translators, and the Hebrew version from a researcher who used it to measure the sleep quality of patients aged 65 years and older with heart failure (Chichashvilli, 2009). The three PSQI language versions were then modified to reflect the goals of the current study. The first version, given to the patient on admission, assessed the patient's sleep quality at home in the prior two weeks instead of four weeks. The second version assessed sleep disturbance during hospitalization and was given to the patient at least 10 days after being hospitalized. Cronbach alpha for the Hebrew version assessing sleep quality at home was 0.77. Because of the sample size, Cronbach alpha could not be calculated for the English (n = 4) and Russian (n = 10) versions of sleep quality for the home or hospital version (n = 27).

MD Anderson Symptom Inventory: The MDASI is a 19-item questionnaire that possesses two subscales (Cleeland et al., 2000). The first subscale, the symptom severity subscale, measures the severity of 12 symptoms (numbness, distress, sadness, shortness of breath, poor appetite, drowsy, dry mouth, fatigue, nausea, pain, difficulty remembering, and vomiting) in the past 24 hours on an 11-point Likert-type scale ranging from 0 (not present) to 10 (as bad as you can imagine). The second subscale, the symptom interference scale, includes six items that measure the degree that the symptoms interfered with work, activity, enjoyment of life, walking, mood, and relations with others. Symptom interference items also are measured from a 0 (did not interfere) to 10 (interfered completely) range. The MDASI has proven validity and reliability and has been used extensively in studies among patients with cancer (Gning et al., 2009; Ivanova et al., 2005; Wang et al., 2010). This study used the English, Russian, and Hebrew versions that have demonstrated good reliability (Cleeland et al., 2000; Ivanova et al., 2005; Prigozin, Uziely, & Musgrave, 2010). Cronbach alpha was 0.81 for the Hebrew version of the symptom severity scale that the patients completed on admission and 0.86 for the symptom interference scale. A small sample size of patients hospitalized for more than 10 days was used for calculation of the Cronbach alpha and, therefore, the Cronbach alpha was not calculated for the MDASI tool. Because of the sample size, Cronbach alpha could not be calculated for the English (n = 4) and Russian (n = 10) versions of MDASI home or hospital questionnaire (n = 27).

Demographic data information questionnaire and disease and treatment questionnaire: A study-specific questionnaire was used to collect data on demographic variables (age, marital status, education, country of birth, employment status, religion, and degree of religiosity). This questionnaire also included items related to the disease (diagnosis, stage, and treatment).

Procedure

After receiving institutional review board permission to conduct the study, data collection was undertaken by nurses in the nursing research group of the oncology department at Hadassah Ein Kerem Hospital who were selected by the head nurse for their expertise in oncology nursing and interest in research. These research nurses then approached potential patients and described the study. If the patient agreed to participate, they signed the informed consent form. The patient then received a research package containing one copy of the PSQI–Home questionnaire, one copy of the PSQI–Hospitalization questionnaire, two copies of the MDASI questionnaire, and one copy of the demographic data information questionnaire. Patients were asked to assess their sleep disturbance using the PSQI–Home and PSQI–Hospitalization, as well as their symptom severity and interference using the MDASI. The initial questionnaire set (PSQI–Home, MDASI, and the demographic data information questionnaire) was completed by the patient within the initial 72 hours of hospitalization and the second set of questionnaires (PSQI–Hospitalization and MDASI) at least 10 days after the patient's admission to the department. Patients who had difficulty completing the questionnaires on their own completed the questionnaires with the help of one of the research nurses. The disease and treatment information questionnaire data were collected by the research nurses from the patients' charts and from the treating physician.

Data Analysis

The data analysis was used to describe the sample, sleep disturbance, symptom severity, and symptom interference; Pearson's r correlations to examine relationships between sleep quality at home and symptom severity and symptom interference in the prior 24 hours; dependent t test to measure differences between sleep quality at home and sleep quality during hospitalization; independent t test to compare differences between demographic variables (gender, age, marital status) and sleep quality at home; Kruskal Wallis to examine differences between demographic variables (education, place of birth, religiosity, employment status), disease, and treatment variables and sleep quality; and Cronbach alpha reliability coefficients to examine reliability of the PSQI–Home and the MDASI on admission.

Results

The majority of the sample were women, married, and with a post-high school education. The most frequent diagnosis was gastrointestinal cancer, followed by breast cancer. Most of the patients were diagnosed with stage IV cancer (n = 54), and 62 of the patients had received chemotherapy or a combination of chemotherapy and radiation (see Tables 1 and 2).

Pittsburgh Sleep Quality Index Global and Individual Components

The mean of the global PSQI scores for the total at home sample was 11.19. However, patients who were

Table 1. Sample Characteristics

Characteristic	$\bar{X}$	SD
Age (years)	62.97	12.23
Characteristic		**n**
Gender		
Female		50
Male		32
Marital status		
Single		5
Married		59
Divorced		10
Widowed		8
Education		
Primary school		11
High school		15
Diploma		21
Bachelor's		11
Master's or above		21
No answer		3
Country or region of birth		
Israel		34
Asia or Africa		21
Russia		12
Eastern Europe		9
Western Europe and America		6
Employment		
Full- or part-time		32
Retired		30
Disabled		6
Homemaker		6
Other		7
No answer		1
Religion		
Jewish		75
Muslim		4
Christian		1
Other		1
No answer		1
Religiosity		
Secular		31
Traditional		28
Religious		15
Very religious or ultra orthodox		8

N = 82

Table 2. Disease and Treatment Characteristics

Characteristic	n
Cancer diagnosis	
Gastrointestinal	29
Breast	16
Gynecologic	7
Lung	6
Brain	5
Prostate	1
Other	17
No answer	1
Stage	
I	5
II	6
III	13
IV	54
No answer	4
Treatment	
Chemotherapy	48
Radiotherapy	9
Combination radiotherapy and chemotherapy	5
Other	1
None	17
No answer	2

N = 82

hospitalized for less than 10 days had lower global PSQI scores at home ($\bar{X}$ = 10.58) than patients who were hospitalized for 10 days or more ($\bar{X}$ = 12.44), although the difference was not significant, t(80) = –0.166, p = 0.1. Sleep duration (component 3) was significantly different between the two groups. Patients who were hospitalized for 10 days or more reported sleeping less at home than those who were hospitalized for fewer days (see Table 3).

Patients who were hospitalized for 10 days or more had significantly higher global PSQI scores at home, t(25) = 2.69, p = 0.013. The global PSQI scores that displayed significant differences between the two time periods (72 hours after admission and at 10 days) were sleep quality (component 1), sleep duration (component 3), and daytime dysfunction (component 7). Although sleep duration scores improved after hospitalization, sleep duration caused the greatest sleep quality disruption (see Table 4 and Figure 1).

Fifty-five patients (67%) were classified as poor sleepers at home (global PSQI score greater than 8). In addition, the percentage of poor sleepers was greater in the group of patients who were to be hospitalized 10 days or longer (n = 21 [78%] versus n = 15 [62%]). However, the percentage of poor sleepers who were hospitalized 10 days or longer decreased after being hospitalized for 10 days or more (n = 15 [62%]).

The greatest cause for sleep disturbance at home and after being hospitalized for 10 days or more was waking up in the middle of the night or early in the morning. This was followed by having to use the bathroom. Patients who were to be hospitalized 10 days or more were more likely to have experienced sleep disturbance at home from pain (three times or more per week) than those who were hospitalized for less than 10 days (67% versus 49%) (see Table 5).

Relationship of Symptom Severity and Interference

A significant relationship was noted between global PSQI scores at home and symptom severity total mean scores (r = 0.35, p = 0.001). The symptom with the greatest correlation with global PSQI scores was numbness (r = 0.32, p = 0.004) followed by distress (r = 0.31, p = 0.004). Interestingly, global PSQI scores were not significantly correlated with either fatigue (r = 0.19, p = 0.085) or pain (r = 0.11, p = 0.319) (see Table 6 and Figure 2). A tendency existed toward a significant relationship between global PSQI scores at hospital and symptom severity total mean scores (r = 0.326, p = 0.052). The symptom with the greatest correlation with global PSQI scores at hospital was sadness (r = 0.371, p = 0.037), followed closely by remembering (r = 0.335, p = 0.047).

Global PSQI scores for the past two weeks at home were significantly related not only to the total symptom

Table 3. Pittsburgh Sleep Quality Index (PSQI) Global and Individual Component Scores in Last Two Weeks on Admission

	Total Sample (N = 82)		Admission 1[a] (N = 55)		Admission 2[b] (N = 27)	
Variable	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD
Global PSQI score	11.19	4.82	10.58	4.85	12.44	4.57
Component 1. Sleep quality	1.67	0.89	1.56	0.89	1.89	0.85
Component 2. Sleep latency	1.67	1.08	1.54	1.1	1.93	1
Component 3. Sleep duration	1.78	1.11	**1.58**	**1.15**	**2.18**	**0.92***
Component 4. Habitual sleep efficiency	1.41	1.32	1.31	1.29	1.63	1.39
Component 5. Sleep disturbance	1.82	0.67	1.78	0.69	1.89	0.64
Component 6. Use of sleeping medication	1.29	1.42	1.36	1.44	1.14	1.37
Component 7. Daytime dysfunction	1.55	1.04	1.44	1.05	1.78	1.01

* p = 0.013

[a] Sample hospitalized less than 10 days

[b] Sample hospitalized for 10 days or more

Note. Higher scores (bolded) indicate significant differences between the two groups.

Table 4. Pittsburgh Sleep Quality Index (PSQI) Global and Individual Components Scores on Admission and Hospitalization for 10 Days or More

Variable	Admission (N = 27) $\bar{X}$	Admission (N = 27) SD	Hospital (N = 27) $\bar{X}$	Hospital (N = 27) SD	Paired t Test	p
Global PSQI score	**12.65**	**4.53**	**10.95**	**4.23**	**2.69**	**0.013**
Component 1. Sleep quality	**1.89**	**0.85**	**1.57**	**0.71**	**2.3**	**0.03**
Component 2. Sleep latency	1.92	1.02	1.75	0.99	1.16	0.257
Component 3. Sleep duration	**2.23**	**0.91**	**1.88**	**1.07**	**2.21**	**0.036**
Component 4. Habitual sleep efficiency	1.69	1.38	1.38	1.32	0.99	0.332
Component 5. Sleep disturbance	1.89	0.64	0.81	0.48	0.7	0.49
Component 6. Use of sleeping medication	1.14	1.37	1.07	1.38	0.25	0.807
Component 7. Daytime dysfunction	**1.78**	**1.01**	**1.37**	**0.97**	**2.02**	**0.054**

N = 82

Note. Higher scores (bolded) indicate significant differences between the two groups.

interference mean scores but all the individual interference item mean scores. The interference items with the greatest correlation to global PSQI scores were patient's general activity (r = 0.42, p = 0.00) and mood (r = 0.4, p = 0.00) (see Table 7). Global PSQI scores for 10 days and more at hospital were significantly related not only to the total symptom interference mean scores (r = 0.415, p = 0.018), but also with the individual interference item mean scores. The interference items with the greatest correlation to global PSQI scores at hospital were patient's enjoyment of life (r = 0.453, p = 0.01), mood (r = 0.397, p = 0.025), and relations with others (r = 0.338, p = 0.045).

Demographic and Disease and Treatment Variables and the Pittsburgh Sleep Quality Index

No significant differences were noted in global PSQI scores at home for the variables of gender, age, marital status, education, place of birth, religiosity, and employment status. Similarly, no significant differences were noted in global PSQI scores at home for cancer diagnosis, stage of the disease, and treatment received.

Symptom Severity and Symptom Interference and the MD Anderson Symptom Inventory

The total symptom severity mean scores across all patient groups ranged from 4.12–4.31. No significant difference was noted in total severity mean scores on admission between those who were hospitalized for less than 10 days and those who were hospitalized for more than 10 days, nor was a significant difference noted between total severity mean scores for patients after being hospitalized for 10 days or more and their means scores when they were admitted. Fatigue was the symptom with the highest mean severity score ($\bar{X}$ range = 6.48–6.7) and problems remembering was the least severe symptom ($\bar{X}$ range = 1.18–1.89) (see Table 8).

The symptom interference total mean scores on admission ranged from 5.61–6.09. The item with the highest mean score on admission was interference with work ($\bar{X}$ range = 7.14–7.56). On the other hand, after 10 days or more in the hospital, the item with greatest mean score was general activity ($\bar{X}$ = 6.22). Similar to symptom severity, no significant difference was noted in total interference mean scores on admission between those patients who were hospitalized for less than 10 days and those who were hospitalized for more than 10 days. However, a trend existed toward significance for total interference mean scores of patients hospitalized 10 days or more. Those patients had higher total mean interference scores on admission than after they had been hospitalized for 10 days or more, t(26) = 1.98, p = 0.058; $\bar{X}$ = 6.09 versus $\bar{X}$ = 5.15. The only interference item that was significantly different for this group was the patient's mood, t(25) = 2.84, p = 0.009; admission, $\bar{X}$ = 3.09; hospitalization, $\bar{X}$ = 3.7 (see Table 9).

Similarly, no significant differences were noted in MDASI symptom severity and symptom interference

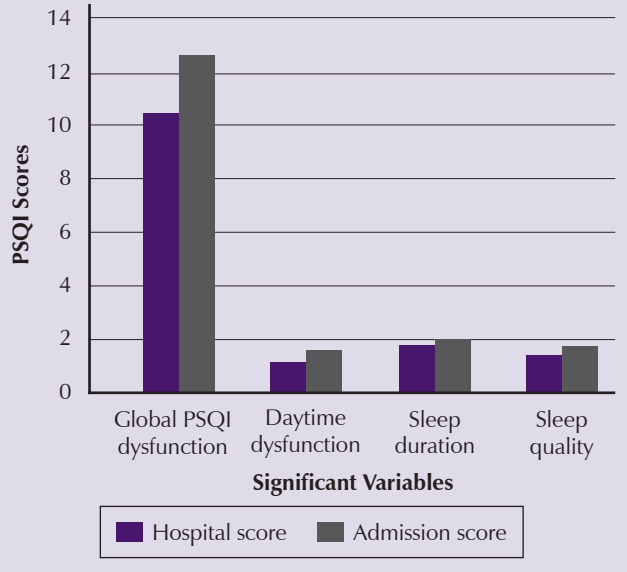

Figure 1. Comparison of Global Pittsburgh Sleep Quality Index (PSQI) Scores on Admission and in Hospital for 10 Days and More

Table 5. Frequencies of Sleep Disturbance Items on Admission

Habitual Sleep Disturbance	Less Than Once Per Week (Score 0–1)		Once or Twice Per Week (Score 2)		Three or More Times Per Week (Score 3)	
	n	%	n	%	n	%
Waking up in the middle of night or early in the morning						
Admission 1	7	13	4	8	42	79
Admission 2	4	15	–	–	23	85
Hospital	–	–	3	11	24	89
Have to use the bathroom						
Admission 1	7	13	5	9	43	78
Admission 2	2	8	4	15	20	77
Hospital	4	15	2	7	21	78
Have pain						
Admission 1	21	38	7	13	27	49
Admission 2	7	26	2	7	18	67
Hospital	8	30	4	15	15	56
Cannot sleep within 30 minutes						
Admission 1	23	43	8	15	22	42
Admission 2	7	26	3	11	17	63
Hospital	8	30	5	19	14	52
Feel too cold						
Admission 1	25	46	8	15	21	39
Admission 2	16	59	5	19	6	22
Hospital	18	67	7	26	2	7
Feel too hot						
Admission 1	36	68	5	9	12	23
Admission 2	17	63	5	19	5	19
Hospital	16	59	8	30	3	11
Cannot breathe comfortably						
Admission 1	42	78	2	4	10	19
Admission 2	16	59	4	15	7	26
Hospital	16	59	3	11	8	30
Cough or snore loudly						
Admission 1	37	69	7	13	10	19
Admission 2	18	67	4	15	5	19
Hospital	21	78	3	11	3	11
Had bad dreams						
Admission 1	44	82	5	9	5	9
Admission 2	22	82	4	15	1	4
Hospital	20	74	4	15	3	11

Note. Admission 1 (n = 55) indicates hospitalized less than 10 days; Admission 2 (n = 27) indicates hospitalization for 10 days or more.

Note. Because of rounding, not all percentages total 100.

mean scores on admission and these demographic variables with one notable exception: women in the study had significantly higher symptom severity mean scores than men, $t(80) = 2.21$, $p = 0.03$; $\bar{X} = 4.5$ versus 3.54. Women participants also had significantly higher symptom interference mean scores than the men, $t(80) = 3.54$, $p = 0.001$; $\bar{X} = 6.58$ versus 4.5.

In addition, no significant differences were noted between MDASI symptom severity and symptom interference mean scores and cancer diagnosis and treatment received. A significant difference, however, did exist between symptom interference mean scores and disease stage, $H(3) = 9.18$, $p = 0.027$. Patients who were diagnosed as having stage IV disease (n = 54) had the highest interference mean scores ($\bar{X} = 6.31$), followed by patients with stage I (n = 5) ($\bar{X} = 5.8$) and stage II (n = 6) ($\bar{X} = 5.66$). The patients with the lowest symptom interference mean scores were patients with stage III disease (n = 13) ($\bar{X} = 3.73$). No significant difference was found between symptom severity mean scores and disease stage.

Discussion

Factors that influence the sleep quality of patients with cancer contribute to the general well-being of patients who are facing a life-threatening disease. This study examined patients' sleep disturbance and the association of symptom severity, symptom interference, and hospitalization. This discussion will examine the sleep quality of patients with cancer in the context of these factors.

Global Pittsburgh Sleep Quality Index on Admission

Patients in this study experienced poor sleep quality at home ($\bar{X} = 11.1$). Their sleep quality was worse than that of patients undergoing bone marrow transplantation shortly before being admitted into the transplantation unit ($\bar{X} = 6.6$) (Rischer et al., 2009), patients with cancer prior to receiving chemotherapy ($\bar{X} = 7.45$) (Beck et al., 2010), and patients with lung cancer receiving chemotherapy ($\bar{X} = 6.86$) (Chen, Yu, & Yang, 2008). However, the sleep quality scores were comparable to a group of Greek patients with terminal illness who were referred to a palliative care unit for pain control ($\bar{X} = 11.7$) (Mystakidou et al., 2007). It may be that the patients in the current study, who were suffering from metastatic disease (n = 54), more closely resembled the sample of patients with advanced-stage cancer in the Greek study.

Pittsburgh Sleep Quality Index Scores on Admission and After Hospitalization for 10 Days or More

The global sleep scores and the individual component scores, with the exception of use of sleeping medication, were all higher at home for the group

Table 6. Bivariate Correlations Between Global Pittsburgh Sleep Quality Index (PSQI) Scores and Total and Individual Symptom Severity on Admission

Variable	r	p
Global PSQI: Home in past two weeks on admission		
Total symptom severity[a]	0.35	0.001
Numbness	0.32	0.004
Distress	0.31	0.004
Sadness	0.24	0.026
Shortness of breath	0.24	0.031
Poor appetite	0.24	0.031
Drowsy	0.22	0.047
Dry mouth	0.21	0.053
Fatigue	0.19	0.085
Nausea	0.153	0.173
Pain	0.11	0.319
Difficulty remembering	0.07	0.541
Vomiting	0.03	0.812

[a] MD Anderson Symptom Inventory sleep disturbance item was not included.

hospitalized 10 days or more than those hospitalized for a shorter period of time. The patients hospitalized for the greater length of time may have been in poorer health. Furlani and Ceolim (2006) supported this view, as their results showed that hospitalized, clinically stable patients with gynecologic and breast cancer experienced better sleep quality during hospitalization. Patients whose situations deteriorated slept less well.

Other studies indicated that patients undergoing stem cell transplantation (Anderson et al., 2007; Rischer et al., 2009) and those on a neurosurgical unit (Sendir et al., 2007; Ugras & Oztekin, 2007) experienced more sleeping issues during the period of treatment with improvements occurring toward the end of the hospitalization period. This may reflect insufficient management of sleep disturbance, as indicated in a study by Hugel, Ellershaw, Cook, Skinner, and Irvine (2004) that evaluated insomnia in palliative care units where only 40% of patients who experienced insomnia were prescribed sleep medication. Of note, the use of sleep medication received the lowest scores across all of the current study groups. This may reflect poor management of sleep disturbance.

A significant difference was noted between patients' PSQI scores at home and 10 days or more after hospitalization. Their PSQI scores after being hospitalized for 10 days or more were lower than at home, although the scores were still high. Most studies that examined sleep disturbance before or on admission and during hospitalization have found that sleep disturbance increased with hospitalization. The sample included hospitalized patients with cancer (Furlani & Ceolim, 2006) and patients who had undergone a bone marrow transplantation (Anderson et al., 2007; Rischer et al., 2009). Only one study (Sendir et al., 2007) found sleep quality improved during hospitalization from baseline data collected on admission (the study was conducted with patients admitted to a neurosurgical ward). The difference was attributed to a decrease in patients' physical and psychological issues after their surgery. Another possible explanation also may be that patients who were hospitalized for 10 days or more were sicker and endured increased anxiety at home related to their deteriorating condition. Being hospitalized, therefore, could be seen as providing a setting that can give help at any hour of the day, thus offering a sense of security that could reduce levels of anxiety and uncertainty.

The greatest cause for sleep disturbance both at home and during hospitalization was waking up in the middle of the night or early in the morning. This cause of sleep disturbance also was described as the leading cause of sleep disturbance for patients with lung or breast cancer receiving chemotherapy (Beck et al., 2010; Chen et al., 2008). Individuals with a life-threatening illness have increased concerns regarding their future that interferes with their normal sleep patterns. A study by Hugel et al. (2004) of two palliative care inpatient units found that 50% of the patients had sleep disturbing thoughts regarding family and future.

Patients who were hospitalized for 10 days or more were more likely to identify pain as a reason for sleep disturbance at home than those who were hospitalized for a shorter period of time. Beck, Dudley, and Barsevick (2005) reported that severe pain caused increased sleep disturbance for patients with cancer in ambulatory and inpatient settings. They alluded that discomfort from pain may contribute to problems with either falling asleep or waking up from sleep.

Pittsburgh Sleep Quality Index and MD Anderson Symptom Inventory Symptom Severity and Symptom Interference

Numbness and tingling displayed the strongest relationship with sleep disturbance. Two studies were found that examined the intercorrelations between the core symptoms of the MDASI severity scale, which included the symptoms of sleep disturbance and numbness and tingling. In research conducted by Gning et al. (2009) of patients diagnosed with thyroid cancer, no significant relationship between numbness and sleep disturbance was found. In a study conducted by Wang et al. (2008) of patients with lung cancer, although numbness and sleep disturbance were significantly correlated, the relationship was the least significant of all the other symptom correlations. This significant finding may reflect the increasing use of chemotherapy drug regimens that cause peripheral neuropathy

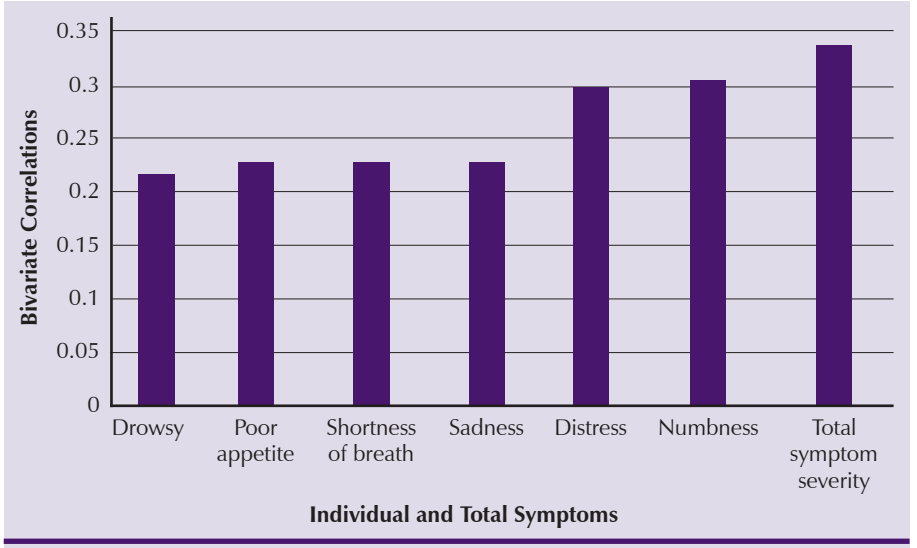

Figure 2. Bivariate Correlations Between Global Pittsburgh Sleep Quality Index Scores and Total and Individual Symptoms Severity Means on Admission

(Verstappen, Heimans, Hoekman, & Postma, 2003). A qualitative study describing the symptom experience of women with breast cancer undergoing treatment with paclitaxel found that peripheral neuropathy was identified as one of the most disturbing symptoms (Boehmke & Dickerson, 2005). In a qualitative study by Bakitas (2007), patients receiving neurotoxic chemotherapy drugs described their neuropathy with words such as "annoying" and "unpleasant." Therefore, the sensations experienced by patients suffering from peripheral neuropathy may cause sleep disturbances.

After numbness and tingling, distress and sadness were the two symptoms that were most strongly correlated with sleep disturbance. That finding is congruent with other studies of the sleep quality of patients with cancer. Significant relationships have been reported between sleep disturbances and depressive symptoms (Otte, Carpenter, Russell, Bigatti, & Champion, 2010), worry (Gregorio et al., 2010), and anxiety (Gibbins et al., 2009).

Of note, pain was not significantly correlated to sleep disturbance. Other research studies that examined this relationship have found conflicting results. Studies conducted of patients with thyroid cancer (Gning et al., 2009) and patients with cancer in an ambulatory setting (McMillan, Tofthagen, & Morgan, 2008) also reported an insignificant relationship between the two symptoms. However, a number of researchers have found that pain can play a large role in disturbed sleep (Beck et al., 2005; Byar et al., 2006; Davidson et al., 2002; Furlani & Ceolim, 2006; Graci, 2005). As suggested in the literature, a number of reasons other than pain may cause sleep disturbance, including emotional stress, medications, depression, and other unpleasant symptoms (Bardwell et al., 2008; Beck et al., 2005; Gooneratne et al., 2007; Graci, 2005; McMillan et al., 2008).

Sleep disturbance was not only significantly related to the total symptom interference score but all the individual dimensions of symptom interference. These relationships are consistently supported by research findings of other studies. PSQI scores for patients with breast cancer were highly correlated to their functional outcomes (Ancoli-Israel et al., 2006). Symptom severity sleep disturbance scores of patients with brain metastasis were significantly different for patients with good and poor Karnofsky scores (Armstrong et al., 2009). Severe sleep disturbance among patients with lung cancer, when compared to the other symptoms, had a great impact on total symptom interference—which was second only to fatigue (Wang et al., 2006). In the current study, the authors found a tendency toward significant relationship between global PSQI scores at hospital and symptom severity total mean scores. The symptoms with the greatest correlation with global PSQI scores at hospital were sadness followed closely by remembering. The findings are of interest because most of the patients were very ill and receiving medication such as morphine, midazolame, and chlorpromazine, all of which affect the ability to remember and also could be associated with terminal illness. Bardwell et al. (2008) noted that a link may exist between insomnia and mood. In their study, Bardwell et al. (2008) found that depressive symptoms emerged as a significant risk factor for insomnia, something Graci (2005) noted as well. McMillan et al. (2008) found a link

Table 7. Bivariate Correlations Between Global Pittsburgh Sleep Quality Index (PSQI) Scores and Total and Individual Symptom Interference Mean Scores on Admission

Variable	r	p
Global PSQI: Home in past two weeks on admission		
Total symptom interference	0.47	0.00
General activity	0.42	0.00
Mood	0.4	0.00
Work	0.39	0.001
Enjoyment of life	0.38	0.00
Relationships with other people	0.36	0.001
Walking	0.22	0.043

Table 8. Symptom Severity on Admission and Hospitalized for 10 Days or More

	On Admission							
	Total (N = 82)		Admission 1[a] (N = 55)		Admission 2[b] (N = 27)		Hospital (N = 27)	
Variable	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD
Total symptom severity score	4.12	1.95	4.03	1.89	4.31	2.1	4.24	2.16
Fatigue	6.58	3.16	6.53	3.24	6.7	3.04	6.48	3.21
Lack of appetite	5.36	3.51	5.39	3.37	5.3	3.84	4.59	4.03
Pain	5.35	3.99	5.09	3.98	5.89	4.01	5.26	3.8
Dry mouth	5.3	3.55	5.14	3.56	5.63	3.59	4.85	3.91
Distressed	4.85	3.61	4.63	3.45	5.3	3.93	4.85	3.79
Sleep disturbance	4.62	3.72	4.36	3.64	5.15	3.89	5.33	3.77
Drowsy or sleepy	4.36	3.69	4.31	3.69	4.44	4.75	4.93	3.43
Sad	4.12	3.48	4.14	3.48	4.07	3.54	3.76	3.78
Nausea	3.85	3.65	3.84	3.59	3.89	3.84	4.52	4.25
Numbness or tingling	2.96	3.46	2.67	3.46	3.56	3.43	3.26	3.47
Shortness of breath	2.37	3.45	2.22	3.46	2.67	3.46	2.74	3.53
Vomiting	2.22	3.42	2.18	3.51	2.3	3.3	3.33	3.53
Remembering	1.65	2.33	1.89	2.35	1.18	2.27	1.26	2.01

[a] Sample hospitalized less than 10 days
[b] Sample hospitalized for 10 days or more

between depressive symptoms, sleep disorders, and pain, and advocated good pain control as one option to improve sleep for patients.

Global PSQI scores for 10 days and more in the hospital were significantly related not only to the total symptom interference mean scores, but also with some items of individual interference item mean scores. The interference items with the greatest correlation to global PSQI scores at hospital were patients' enjoyment of life, mood, and relations with others. The current study's findings could be supported by the fact that most of the patients had terminal illness (stage IV) and were confined to bed; therefore, they were mostly restricted from joining activities that they previously enjoyed doing.

MD Anderson Symptom Inventory Symptom Severity and Symptom Interference

No significant difference in total severity mean scores were noted on admission between those who were hospitalized for less than 10 days and those who were hospitalized for more than 10 days. Nor was a significant difference noted between total severity mean scores for patients after being hospitalized for 10 days or more and their means scores when they were admitted. These findings support the point of view that patients who were hospitalized for 10 days or more were very ill and potentially experienced more suffering.

Symptom interference: The item with the highest mean score on admission was interference with work. However, after 10 days or more in the hospital, the item with greatest mean score was general activity. Similar to symptom severity, no significant difference was noted in total interference mean scores on admission between patients who were hospitalized for less than 10 days and those who were hospitalized for 10 days or more. A trend toward significance did exist for total interference mean scores of patients hospitalized 10 days or more. These patients had higher total mean interference scores on admission than after they had been hospitalized for 10 days or more. This supports the point of view that patients who were hospitalized for 10 days or more were suffering more from their symptoms and were more seriously ill. Interestingly, the only interference item that was significantly different for this group was the patient's mood. Women had significantly higher symptom severity mean scores than the men. Women patients also had significantly higher symptom interference mean scores than the men. Inconsistencies exist in the literature concerning gender-related problems in sleeping: some authors mentioned that women seem to suffer more from difficulties sleeping (Davidson et al., 2002), whereas Sendir et al. (2007) showed that male hospitalized patients with neurosurgical issues had more problems sleeping. In patients receiving bone marrow transplantation, no gender-related correlation was found (Rischer et al., 2009).

No significant differences were noted between MDASI symptom severity and symptom interference mean scores and cancer diagnosis and treatment received. However, a significant difference was noted between symptom interference mean scores and disease stage. Patients who were diagnosed as having stage IV disease had the highest interference mean scores, followed by patients with stage I and then stage II. The patients with the lowest symptom interference mean scores were patients with stage III disease. No significant difference was noted between symptom severity mean scores and disease stage.

In patients with breast cancer, a link between sleep disturbance and the stage of illness appeared likely. Patients with a stage I or II diagnosis seemed to sleep less well than patients with stage III disease (Bardwell et al., 2008). Gibbins et al. (2009) found sleep disturbance

to be a prevalent issue in patients with advanced-stage cancer. They also stated that no specific link existed between certain types of cancer and sleeping problems. However, a study by Silberfarb, Hauri, Oxman, and Schnurr (1993) revealed a connection between poor sleep and lung or breast cancer.

Limitations

This study has several limitations. First, although patients were asked to evaluate sleep disturbance at home, the experience of admission into the hospital may have influenced their perception of their sleep quality. Secondly, the sample size of the patients who were hospitalized for 10 days or more was small. Finally, the evaluation of sleep disturbance factors did not include hospital environmental sleep disturbance factors.

Conclusions

The authors' decision to study the relationship between sleep disturbance and other common cancer-related symptoms was connected with the desire to implement professional interventions that would bring relief to the patients. These findings call for special attention because identifying and treating disturbing symptoms may help improve patients' sleep and quality of life.

A significant association was found between sleep disturbance and symptoms: numbness and distress had the highest significant association, followed by sadness, poor appetite, and shortness of breath. Of note, the most common complaints of patients with cancer (pain, fatigue, and nausea and vomiting) were not found to be significantly associated with sleep disturbance. Treatment protocols are already in place for pain, fatigue, and nausea and vomiting, and the nursing staff is aware of them. The authors recommend building protocols for treating the symptoms found in the current study.

Implications for Nursing

The authors used the MDASI interference scale to learn about the association between sleep disturbance and every day activities. General activity, mood, work, and enjoyment of life are significantly related to sleep disturbances.

Sleep disturbance was significantly greater at home than after hospitalization among patients with advanced-stage cancer. This identifies the need for a more focused analysis of the factors that not only influence sleep disturbance in the hospital, but also at home. When considering the high percentage of sleep disturbance at home found in the current study, it clearly is important to maintain a continuity of care after discharge.

Patients did not often use sleep-enhancing medications either at home or during hospitalization, even when suffering from severe sleep disturbance. Nurses need to examine the reasons why patients with poor sleep quality do not use medications that might enhance their sleep quality. In addition, the influence of neuropathies on sleep disturbance requires closer examination, particularly with the increased use of neuropathic chemotherapy agents such as taxanes. Nursing studies that more closely examine the relationship of peripheral neuropathies caused by cytotoxic drugs and sleep disturbance should be designed.

Despite some methodologic weaknesses and the small sample size, the current study has identified sleep disturbances in a population that previously has not been studied and has found that sleep disturbances occur less during hospitalization than at home. This provides information related to sleep disturbances and factors that affect the quality of sleep. Its content can be seen as being relevant for oncology nursing, research, and further studies.

The information obtained must be considered by nurses and other healthcare providers when choosing the appropriate intervention, keeping in mind the association between sleep disturbance and other symptoms found in the current study. The authors intend to write a protocol which allows nurses to proceed with pharmaceutical interventions without a need for a doctor's prescription each time. The protocol will be authorized by leading doctors and hospital regulations.

Table 9. Symptom Interference on Admission and Hospitalized for 10 Days or More

	On Admission							
	Total (N = 82)		Admission 1[a] (N = 55)		Admission 2[b] (N = 27)		Hospital (N = 27)	
Variable	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD
Total symptom interference	5.76	2.78	5.61	2.91	6.09	2.51	5.15	2.85
Work	7.28	3.51	7.14	3.49	7.56	3.62	6.09	4.33
General activity	6.61	3.61	6.43	3.71	6.96	3.46	6.22	3.6
Walking	6.42	3.61	6.28	3.6	6.7	3.68	5.85	3.37
Enjoyment	5.9	3.75	5.72	3.77	6.26	3.76	4.89	4.19
Mood	5.66	3.54	5.17	3.69	6.63	3.04	4.42	3.7
Relationship	3.06	3.56	3.33	3.66	2.52	3.37	3.26	3.46

[a] Sample hospitalized less than 10 days
[b] Sample hospitalized for 10 days or more

Considering the high percentage of sleep disturbance at home found in the current study, maintaining a continuity of care after discharge is clearly important. Creating intervention plans with drug protocols and a discharge plan, plus building connections with outpatient clinics and with hospice care, will empower nurses.

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References

Ancoli-Israel, S., Liu, L., Marler, M.R., Parker, B.A., Jones, V., Sadler, G.R., . . . Fiorentino, L. (2006). Fatigue, sleep, and circadian rhythms prior to chemotherapy for breast cancer. *Supportive Care in Cancer, 14,* 201–209. doi:10.1007/s00520-005-0861-0

Anderson, K.O., Giralt, S.A., Mendoza, T.R., Brown, J.O., Neumann, J.L., Mobley, G.M., . . . Cleeland, C.S. (2007). Symptom burden in patients undergoing autologous stem cell transplantation. *Bone Marrow Transplantation, 39,* 759–766. doi:10.1038/sj.bmt.1705664

Armstrong, T.S., Gning, I., Mendoza, T.R., Weinberg, J.S., Gilbert, M.R., Tortorice, M.L., & Cleeland, C.S. (2009). Clinical utility of the MDASI-BT in patients with brain metastases. *Journal of Pain and Symptom Management, 37,* 331–340. doi:10.1016/j.jpainsymman.2008.02.011

Bakitas, M.A. (2007). Background noise: The experience of chemotherapy-induced peripheral neuropathy. *Nursing Research, 56,* 323–331. doi:10.1097/01.NNR.0000289503.22414.79

Bardwell, W.A., Profant, J., Casden, D.R., Dimsdale, J.E., Ancoli-Israel, S., Natarajan, L., . . . Pierce, J.P. (2008). The relative importance of specific risk factors for insomnia in women treated for early-stage breast cancer. *Psycho-Oncology, 17,* 9–18. doi:10.1002/pon.1992

Beck, S.L., Berger, A.M., Barsevick, A.M., Wong, B., Stewart, K.A., & Dudley, W.N. (2010). Sleep quality after initial chemotherapy for breast cancer. *Supportive Care in Cancer, 18,* 679–689. doi:10.1007s00520-009-0662-y

Beck, S.L., Dudley, W.N., & Barsevick, A. (2005). Pain, sleep disturbance, and fatigue in patients with cancer: Using a mediation model to test a symptom cluster [Online exclusive]. *Oncology Nursing Forum, 32,* E48–E55. doi:10.1188/05.ONF.E48-E55

Berger, A.M., Parker, K.P., Young-McCaughan, S., Mallory, G.A., Barsevick, A.M., Beck, S.L., . . . Hall, M. (2005). Sleep wake disturbances in people with cancer and their caregivers: State of the science [Online exclusive]. *Oncology Nursing Forum, 32,* E98–E126. doi:10.1188/05.ONF.E98-E126

Boehmke, M.M., & Dickerson, S.S. (2005). Symptom, symptom experiences, and symptom distress encountered by women with breast cancer undergoing current treatment modalities. *Cancer Nursing, 28,* 382–389. doi:10.1097/00002820-200509000-00008

Buysse, D.J., Reynolds III, C.F., Monk, T.H., Berman, S.R., & Kupfer, D.J. (1989). The Pittsburgh Sleep Quality Index: A new instrument for psychiatric practice and research. *Psychiatry Research, 28,* 193–213. doi:10.1016/0165-1781(89)90047-4

Byar, K.L., Berger, A.M., Bakken, S.L., & Cetak, M.A. (2006). Impact of adjuvant breast cancer chemotherapy on fatigue, other symptoms, and quality of life [Online exclusive]. *Oncology Nursing Forum, 33,* E18–E26. doi:10.1188/06.ONF.E18-E26

Carpenter, J.S., & Andrykowski, M.A. (1998). Psychometric evaluation of the Pittsburgh Sleep Quality Index. *Journal of Psychosomatic Research, 45,* 5–13. doi:10.1016/S0022-3999(97)00298-5

Chen, M.L., & Chang, H.K. (2004). Physical symptom profiles of depressed and nondepressed patients with cancer. *Palliative Medicine, 18,* 712–718. doi:10.1191/0269216304pm950oa

Chen, M.L., Yu, C.T., & Yang, C.H. (2008). Sleep disturbances and quality of life in lung cancer patients undergoing chemotherapy. *Lung Cancer, 62,* 391–400. doi:10.1016/j.lungcan.2008.03.016

Chichashvilli, M. (2009). *Quality of life and quality of sleep in patients 65 years and older with heart failure* (Unpublished master's thesis). Henrietta Szold Hadassah Hebrew University School of Nursing, Jerusalem, Israel.

Cleeland, C.S. (2007). Symptom burden: Multiple symptoms and their impact as patient-reported outcomes. *Journal of the National Cancer Institute. Monographs, 37,* 16–21. doi:10.1093/jncimonographs/lgm005

Cleeland, C.S., Mendoza, T.R., Wang, X.S., Chou, C., Harle, M.T., Morrissey, M., & Engstorm, M.C. (2000). Assessing symptom distress in cancer patients: The M.D. Anderson Symptom Inventory. *Cancer, 89,* 1634–1646. doi:10.1002/1097-0142(20001001)89:7<1634::AID-CNCR29>3.0.CO;2-V

Cohen, J. (1992). A power primer. *Psychological Bulletin, 112,* 155–159. doi:10.1037/0033-2909.112.1.155

Davidson, J.R., MacLean, A.W., Brundage, M.D., & Schulze, K. (2002). Sleep disturbance in cancer patients. *Social Science and Medicine, 54,* 1309–1321. doi:10.1016/S0277-9536(01)00043-0

Furlani, R., & Ceolim, M.F. (2006). Sleep quality of women with gynecological and breast cancer. *Revista Latino-Americana de Enfermagem, 14,* 872–878. doi:10.1590/S0104-11692006000600007

Gibbins, J., McCoubrie, R., Kendrick, A.H., Senior-Smith, G., Davies, A.N., & Hanks, G.W. (2009). Sleep-wake disturbances in patients with advanced cancer and their family carers. *Journal of Pain and Symptom Management, 38,* 860–870. doi:10.1016/j.jpainsymman.2009.04.025

Given, B.A., Given, C.W., Sikorskii, A., & Hadar, N. (2007). Symptom clusters and physical function for patients receiving chemotherapy. *Seminars in Oncology Nursing, 23,* 121–126. doi:10.1016/j.soncn.2007.01.005

Gning, I., Trask, P.C., Mendoza, T.R., Harle, M.T., Gutierrez, K.A., Kitaka, S.A., . . . Cleeland, C.S. (2009). Development and initial validation of the thyroid cancer module of the M.D. Anderson Symptom Inventory. *Oncology, 76,* 59–68. doi:10.1159/000178809

Gooneratne, N.S., Dean, G.E., Rogers, A.E., Nkwuo, J.E., Coyne, J.C., & Kaiser, L.R. (2007). Sleep and quality of life in long-term lung cancer survivors. *Lung Cancer, 58,* 403–410. doi:10.1016/j.lungcan.2007.07.011

Graci, G. (2005). Pathogenesis and management of cancer-related insomnia. *Journal of Supportive Oncology, 3,* 349–359.

Gregorio, S.W., Gustin, J., Marks, D., Taylor, R., Coller, K., & Magalang, U. (2010). Worry as a significant predictor of insomnia among palliative care patients with advanced cancer. *Journal of Pain and Symptom Management, 39,* 335–336. doi:10.1016/j.jpainsymman.2009.11.249

Hugel, H., Ellershaw, J.E., Cook, L., Skinner, J., & Irvine, C. (2004). The prevalence, key causes and management of insomnia in palliative care patients. *Journal of Pain and Symptom Management, 27,* 316–321. doi:10.1016/j.jpainsymman.2003.09.010

Ivanova, M.O., Ionova, T.I., Kalyadina, S.A., Uspenskaya, O.S., Kishtovich, A.V., Guo, H., . . . Wang, X.S. (2005). Cancer-related symptom assessment in Russia: Validation and utility of the Russian M.D. Anderson Symptom Inventory. *Journal of Pain and Symptom Management, 30,* 443–453. doi:10.1016/j.jpainsymman.2005.04.015

Mao, J.J., Armstrong, K., Bowman, M.A., Xie, S.X., Kadakia, R., & Farrar, J.T. (2007). Symptom burden among cancer survivors: Impact of age and comorbidity. *Journal of the American Board of Family Medicine, 20,* 434–443. doi:10.3122/jabfm.2007.05.060225

McMillan, S.C., Tofthagen, C., & Morgan, M.A. (2008). Relationships among pain, sleep disturbances, and depressive symptoms in outpatients from a comprehensive cancer center. *Oncology Nursing Forum, 35,* 603–611. doi:10.1188/08.ONF.603-611

Miaskowski, C., Cooper, B.A., Paul, S.M., Dodd, M., Lee, K., Aouizerat, B.E., . . . Bank, A. (2006). Subgroups of patients with cancer with different symptom experiences and quality-of-life outcomes: A cluster analysis [Online exclusive]. *Oncology Nursing Forum, 33,* E79–E89. doi:10.1188/06.ONF.E79-E89

Mystakidou, K., Parpa, E., Tsilika, E., Gennatas, C., Galanos, A., & Vlahos, L. (2009). How is sleep quality affected by the psychological and symptom distress of advanced cancer patients? *Palliative Medicine, 23,* 46–53. doi:10.1177/0269216308098088

Mystakidou, K., Parpa, E., Tsilika, E., Pathiaki, M., Patiraki, E., Galanos, A., & Vlahos, L. (2007). Sleep quality in advanced cancer patients. *Journal of Psychosomatic Research, 62,* 527–533. doi:10.1016/j.jpsychores.2006.11.008

Otte, J.L., Carpenter, J.S., Russell, K.M., Bigatti, S., & Champion, V.L. (2010). Prevalence, severity, and correlates of sleep-wake disturbances in long-term breast cancer survivors. *Journal of Pain and Symptom Management, 39,* 535–547. doi:10.1016/j.jpainsymman.2009.07.004

Prigozin, A., Uziely, B., & Musgrave, C.F. (2010). The relationship between symptom severity and symptom interference, education, age, marital status, and type of chemotherapy treatment in Israeli women with early-stage breast cancer [Online exclusive]. *Oncology Nursing Forum, 37,* E411–E418. doi:10.1188/10.ONF.E411-E418

Pud, D., Ben Ami, S., Cooper, B.A., Aouizerat, B.E., Cohen, D., Radiano, R., . . . Miaskowski, C. (2008). The symptom experience of oncology outpatients has a different impact on quality-of-life outcomes. *Journal of Pain and Symptom Management, 35,* 162–170. doi:10.1016/j.jpainsymman.2007.03.010

Rischer, J., Scherwath, A., Zander, A.R., Koch, U., & Schulz-Kindermann, F. (2009). Sleep disturbances and emotional distress in the acute course of hematopoietic stem cell transplantation. *Bone Marrow Transplantation, 44,* 121–128. doi:10.1038/bmt.2008.430

Savard, J., & Morin, C.M. (2001). Insomnia in the context of cancer: A review of a neglected problem. *Journal of Clinical Oncology, 19,* 895–908.

Sela, R.A., Watanabe, S., & Nekolaichuk, C.L. (2005). Sleep disturbances in palliative cancer patients attending a pain and symptom control clinic. *Palliative and Supportive Care, 3,* 23–31. doi:10.1017/S1478951505050042

Sendir, M., Acaroglu, R., Kaya, H., Erol, S., & Akkaya, Y. (2007). Evaluation of quality of sleep and effecting factors in hospitalized neurosurgical patients. *Neurosciences, 12,* 226–231.

Silberfarb, P.M., Hauri, P.J., Oxman, T.E., & Schnurr, P. (1993). Assessment of sleep in patients with lung cancer and breast cancer. *Journal of Clinical Oncology, 11,* 997–1004.

Ugras, G.A., & Oztekin, S.D. (2007). Patient perception of environmental and nursing factors contributing to sleep disturbance in a neurosurgical intensive care unit. *Tohoku Journal of Experimental Medicine, 212,* 299–308. doi:10.1620/tjem.212.299

Verstappen, C.C.P., Heimans, J.J., Hoekman, K., & Postma, T.J. (2003). Neurotoxic complications of chemotherapy in patients with cancer: Clinical signs and optimal management. *Drugs, 63,* 1549–1563. doi:10.2165/00003495-200363150-00003

Wang, S.Y., Tsai, C.M., Chen, B.C., Lin, C.H., & Lin, C.C. (2008). Symptom clusters and relationships to symptom interference with daily life in Taiwanese lung cancer patients. *Journal of Pain and Symptom Management, 35,* 258–266. doi:10.1016/j.jpainsymman.2007.03.017

Wang, X.S., Cleeland, C.S., Mendoza, T.R., Yun, Y.H., Wang, Y., Okuyama, T., & Johnson, V.E. (2010). Impact of cultural and linguistic factors on symptom reporting by patients with cancer. *Journal of the National Cancer Institute, 102,* 732–738. doi:10.1093/jnci/djq097

Wang, X.S., Fairclough, D.L., Liao, Z., Komaki, R., Chang, J.Y., Mobley, G.M., & Cleeland, C.S. (2006). Longitudinal study of the relationship between chemoradiation therapy for non-small-cell lung cancer and patient symptoms. *Journal of Clinical Oncology, 24,* 4485–4491. doi:10.1200/JCO.2006.07.1126

Yi, Z., Wang, X.S., & Ping-Ping, L. (2008). Investigation of common symptoms of cancer and reliability analysis. *Chinese Journal of Integrative Medicine, 7,* 195–199.